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USSR Report

ENGINEERING AND EQUIPMENT

(FOUO 5/81)

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THEORY AND DESIGN OF ENGINES AND FLIGHTCRAFT

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MARINE AND SHIPBUILDING

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ELECTRICAL INSTALLATION OPERATIONS ON SHIPS

Leningrad TEKHNOLOGIYA SUDOVYKH ELEKTROMONTAZHNYKH RABOT in Russian 1981 (signed to press 29 Dec 80) pp 2, 207-208

[Annotation and table of contents from book "Methods of Electrical Installation Operations on Ships", by Konstantin Yefimovich Akulov, Boris Davidovich Gandin, Yuriy Polikarpovich Shakurin and Georgiy Semenovich Yakovlev, Izdatel'stvo "Sudostroyeniye", 9,000 copies, 208 pages]

[Text] The technological processes for performing electrical installation work on modern ships are set out in the book. The contents of the design and technological documentation necessary for this are examined. A description of methods for testing marine electrical equipment is given. The organizational principles for performing electrical installation work and fundamentals of planning and standardization are set out.

The book is intended as a textbook for students at shipbuilding technical schools in the department of "Marine Electrical Equipment", and may be used during vocational training of plant workers.

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UDC [629.124.9.039.001.2+629.124.9:533.693](031)

HANDBOOK FOR DESIGNING SHIPS WITH DYNAMIC SUPPORT PRINCIPLES

Leningrad SPRAVOCHNIK PO PROYEKTIROVANIYU SUDOV S DINAMICHESKIMI PRINTSIPAMI PODDERZHANIYA in Russian 1980 (signed to press 15 Jan 80) pp 2, 467-471

[Annotation and table of contents from book "Handbook for Designing Ships With Dynamic Support Principles", by Boris Aleksandrovich Kolyzayev, Anatoliy Ivanovich Kosorukov and Vladilen Aleksandrovich Litvinenko, Izdatel'stvo "Sudostroyeniye", 4,000 copies, 472 pages]

[Text] Basic information on the theory and practice of designing hydrofoils and hovercraft (HF and HC) are systematized. Methods for determining the primary dimensions of these ships, their transport and their seafaring properties, and economic characteristics are set out. Methods for optimization of design decisions are indicated, and an analysis of errors in the design of HF and HC components is given. A principle for setting structural reserves is substantiated. Questions concerning the reliability and safety of these ships are covered.

The reference book is intended for shipbuilding engineers, specialists at scientific research institutes and the design offices of shipbuilding enterprises and the navy; it may be useful to graduate students and upperclassmen at shipbuilding vuzes and departments.

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METAL SURFACE STATE OF RBMK-1000 NUCLEAR POWER PLANT SYSTEMS AFTER INSTALLATION

Moscow ATOMNAYA ENERGIYA in Russian Vol 50, No 3, Mar 81 (manuscript received 29 May 80) pp 181-183

[Article by V.M. Sedov, P.G. Krutikov, A.I. Grushanin, S.T. Zolotukhin, Yu.O. Zakharzhevskiy and A.P. Yeperin]

[Text] The initial state of the metal surfaces of AES systems and equipment is governed to a significant extent by the corrosion behavior of the structural materials during start-up and in the first operational period [1, 2]. It is generally well known that with the impact of external effects during the transportation, storage and installation period, a metal surface can change its properties. It is essential to determine the physical and chemical characteristics of the internal surfaces of the main and auxiliary systems of AES for the subsequent selection of the optimal chemical process modes to prepare them for operation. The results of a study of the state of the surfaces of some production process systems of the third unit of the Leningradskaya AES in the concluding stage of the assembly are treated in this paper and the major systems of the unit are enumerated with the approximate quantity of construction materials used indicated (with respect to the surface) (Table 1). Primary attention is devoted to the portions of the loops and systems manufactured from pearlite and low alloy steel (the condensate feed and steam lines, the biological protection system), since these steels are the least corrosion resistant of those used in AES circuits.

The state of the surfaces was studied by means of inspecting, photographing and taking samples of surface contaminants at the open ends of the piping units. A phase analysis of the selected oxides was accomplished with a gamma resonance YaGRS-4M spectrometer. The specific weight of the contamination of the internal surfaces of the equipment and piping was determined by a weighing technique with mechanical removal of the oxides and incorporation of an averaged removal coefficient based on the results of cathode etching of cut-out samples [3]. The thickness of the corrosion product layer was checked with an MMR-2R microscope using metallographic polished specimens. The electrochemical characteristics were found using a P-5827M potentiostat by means of comparative analysis of the anode potentiodynamic curves for the metal coated with oxides and the metal with a mechanically cleaned surface; a borate buffer solution at a pH of 7.4 was used as the electrolyte (the potentials are given relative to a normal hydrogen electrode).

TABLE 1

The Area of the Structural Materials which are in Contact with the Coolant in One Unit of a Nuclear Electric Power Station with an RBMK Reactor, m^2

Systems	Steel			Other Steels and Alloys
	Austenitic	Zirconium	Pearlite	
The multiple forced circulation loop (KMPTs)	38 700 0Kh18N10T	9300	150	-
Condensate feed channel (KPT) and live steam piping	12 000 12Kh18N10T	-	4880*	40480* (MNZh)
Emergency reactor cooling systems (SAOR)	25 000	-	-	-
Intermediate cooling loop for purging the multiple forced circulation loop (heat exchangers, control and safety rods, main circulation pump, after-coolers, pipes)	7000	-	1300	-
The system for collecting, cleaning and utilizing the systematic small leaps and low salt content water	1000	-	-	-
The control and safety rods cooling loop	6500	470	-	30 (SAV-1)
The biological shielding system	1200	-	-	1500 (10KhSND)
The system for collecting and reprocessing trap waters	5000	-	-	-

*Per one unit turbine.

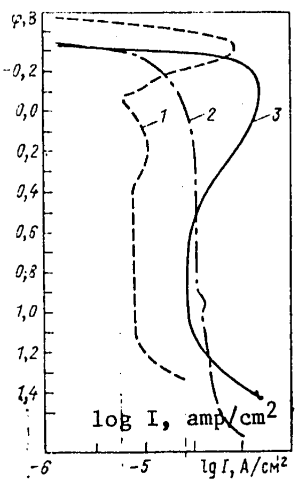

Figure 1. The anode potentiodynamic polarization curve for St. 20 in a borate buffer solution (pH = 7.4):

The dashed curve is for a mechanically cleaned surface;
The dashed and dotted and the solid curves are for a surface with a predominance of scale and friable corrosion products respectively.

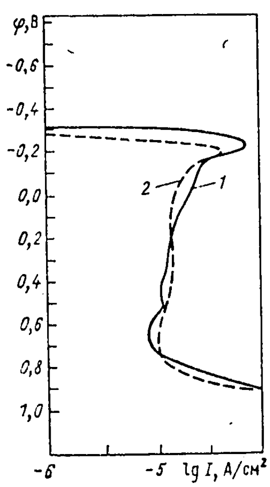

Figure 2. Anode potentiodynamic polarization curve for the MNZh alloy in a borate buffer solution (pH = 7.4):

The solid curve is for a surface coated with a black oxide film;
The dashed curve is for a mechanically cleaned surface.

It was ascertained during a visual inspection of the internal surfaces of the equipment made of austenitic steels during assembly that they contain practically no iron oxides which are formed during the process of equipment storage and installation; the contaminants consist primarily of dust, splashes of structural concrete and welding burrs. It was found during the inspection of the inner surfaces of the piping of the condensate feed channel and the main steam lines, the primary structural material of which is St 20, that the surface is coated with a layer of reddish-brown corrosion products, and in some places, there are thermal scale residues. The layer of corrosion products is basically uniform, and in places where atmospheric moisture has formed droplets, it is thicker and more friable.

TABLE 2

The Qualitative and Quantitative Composition of Corrosion Products on the Internal Surfaces of Equipment

Система System	(1) Общее количество продуктов коррозии, г/м²	Фазовый состав, % Phase Composition, %			
		γ-FeOOH	Fe_3O_4	α-Fe_2O_3	γ-Fe_2O_3
(2) Главные паропроводы (ст. 20)	110±20	0—80	20—50	0—50	0—20
КПТ (ст. 20):					
(3) деаэраторы (a)	100±20	0—70	20—50	0—60	0—20
трубопроводы (b)	150±30	0—90	10—50	0—50	0—10
Бак биологической защиты (4) (ст. 10ХСНД)	100±20	0—80	10—50	0—40	0—10

Key: 1. The overall quantity of corrosion products, g/m²;
2. The main steam lines (St. 20);
3. The condensate feed channel (St. 20): (a). deaerators; (b). pipes;
4. Biological shielding tank (St. 10KhSND).

It can be seen from an analysis that the overall quantity of corrosion products on the surface of pearlite steel amounts to 100 to 170 g/m². The layer of corrosion products consists of iron oxide which are weakly bonded to the surface (easily removed with a rubber eraser after 10 minutes exposure to ethyl alcohol), and a dark brown, almost black oxide film, which is directly adjacent to the surface and firmly bonded to the metal. More than 50 percent of the corrosion products are found in the friable portion of the layer, something which accounts for its low average density: 1.8 g/cm³ for a thickness of (75 ± 10) micrometers. The nature and the composition of the layer of corrosion products on the internal surfaces of the biological protection tank (10 KhSND steel) practically do not differ from those on the surface of equipment made of pearlite steel, although the quantity of corrosion products is somewhat smaller and amounts to 100 ± 20 g/m². The qualitative and quantitative composition of the deposits on the internal surfaces of equipment are given in Table 2*.

*The authors consider it their pleasant duty to express their gratitude to V.A. Shishkunov and A.A. Afanaf'yev, who performed the phase analysis of the deposits.

The potentiodynamic study of the surface using cutout samples from actual pipe showed that its electrochemical characteristics can differ significantly (Figure 1). When measuring different sections of the surface, it was determined that the current density at the same potential on adjacent sections can differ by more than an order of magnitude. In a range of potentials of from -0.4 volts to -0.6 volts on different sections, by anodic and cathodic current were noted. The anodic current density reaches 200 $\mu A/cm^2$ and the cathodic reaches 50 $\mu A/cm^2$. It was determined by means of galvanic static measurements that in the case of a cathodic current flow of 50 $\mu A/cm^2$, the potential difference across different but still close sections of the surface can reach 0.5 to 0.6 volts.

In a study of the internal surfaces of the pipes and equipment of AES's fabricated from pearlite steel, it was ascertained that the physical and chemical state and the chemical activity of the sections closest together differ considerably. This is responsible for the increase in the rate of both the general as well as the local corrosion. For this reason, to reduce the chemical activity, pearlite steels need special chemical technological treatment. In an inspection of the pipes of turbine condensers, fabricated from MNZh alloy, it was determined that their surface was coated with a rather uniform black oxide film with a thickness of 60 $\pm$ 10 micrometers.

The anode potentiodynamic curves for the MNZh alloy in the initial state and with a mechanically clean surface differ insignificantly (Figure 2), while the range of steady-state potentials of the alloys surface amounts to -0.18 to -0.19 volts.

Tests which were performed under dynamic conditions for a distilled water flow rate of 2 m/sec and a temperature of 120 °C showed that the corrosion rate of the samples with a mechanically cleaned surface is somewhat higher than in the initial state and amounts to 0.155 and 0.124 $g/(m^2 \cdot day)$ respectively, i.e., the MNZh alloy does not need special chemical treatment prior to the start.

Conclusions. The surface of AEM systems and loop sections, fabricated from pearlite steels, is in a chemically active state after assembly. To reduce its activity, it is necessary to employ a special chemical technology. The quantity of corrosion products on the surface of equipment made of pearlite steel, depending on the conditions for transportion, storage and installation, amounts to 100 to 170 g/m^2, where the main components are: γ-FeOOH; Fe_3O_4; α-Fe_2O_3 and γ-Fe_2O_3. The surface of equipment made of austenitic steels and MNZh alloy requires only hydraulic cleaning of the mechanical contaminants.

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MEASUREMENTS OF SPECTRAL INDICES IN UNIFORM RBMK REACTOR LATTICES FOR VARIOUS CHANNEL TO GRAPHITE TEMPERATURE GRADIENTS

Moscow ATOMNAYA ENERGIYA in Russian Vol 50, No 3, Mar 81 (manuscript received 6 Aug 79) pp 176-181

[Article by P.M. Kamanin, M.B. Yegiazarov, V.S. Romanenko, O.S. Feynberg and V.V. Khmyzov]

[Text] Knowledge of the laws governing the formation of neutron spectra in the thermal and epithermal energy ranges for RBMK [channel type boiling water high power reactor] lattices is necessary for the calculation of the temperature and power reactivity coefficients which determine reactor stability, as well as for the calculation of the reactivity, fuel depletion and energy distribution. The precise calculation of the parameters of the thermal neutron spectrum in RBMK's with considerable heterogeneity with large temperature gradients within the bounds of a cell is a complex problem. Because of the approximate nature of engineering calculation techniques for RBMK's, it has become necessary to obtain a set of experimental data to check them.

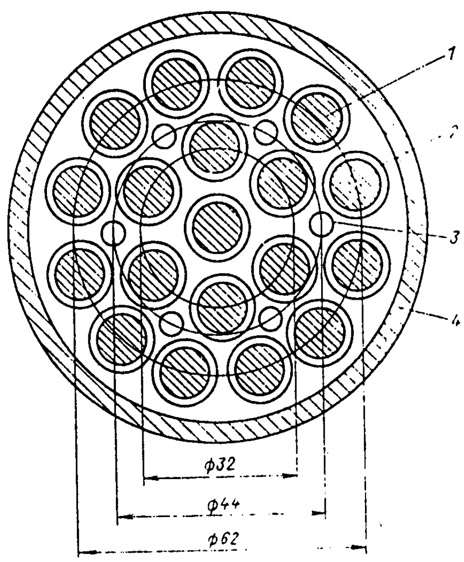

Figure 1. Cross-section of the channel with the cassette.

Key:
1. UO_2 tablet 11 mm in diameter, with a density of 10.4 g/cm^3;
2. Fuel element jacket with a diameter of 13.5 x 1.0 mm;
3. Substitute rod 6 mm in diameter;
4. Process pipe with a diameter of 88 x 4 mm (fuel element jacket, rod, and production pipe are fabricated from aluminum alloy).

TABLE 1

Temperature Modes in RBMK Fuel Lattice Cells and the Test Stand, °C

Unit Being Measured	Graphite Temperature, °C	Water Temperature, °C	T_{gr}/T_{water}
RBMK-1000	600	280	1.58
Temperature test stand	20	20	1.00
	80	20	1.21
	80	70	1.03
	200	30	1.56
	300	40	1.83

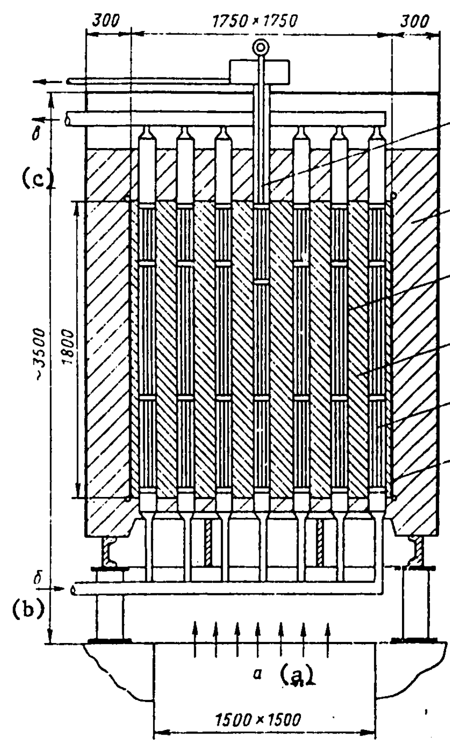

Figure 2. Schematic of the RBMK temperature test stand.

Key:
1. Electrical heating rod;
2. RBMK type cassette;
3. Graphite brickwork;
4. Process channel
5. Thermal insulation (fireclay);
6. Experimental channel;

a. Neutron flux from the F-1 reactor;
b,c. Water from the heat exchanger and to the heat exchanger.

The slow neutron spectrum ($E_n \leq 1$ eV) in RBMK fuel cells is governed by the moderating and absorbing properties of the channel, as well as the temperature of individual regions of the cell. In this case, a substantial change in the neutron spectrum is observed in the region of a sharp change in the parameters.

Experiments using homogeneous lattices of mockup cassettes of the RBMK type with uranium dioxide with and without water in the channels are described in this paper. The cross-section of the cassettes is shown in Figure 1. The experiments were performed on an RBMK temperature test stand, specially designed for performing the experiments. The stand (Figure 2) takes the form of a subcritical uranium-graphite assembly with dimensions of 175 x 175 x 180 cm, installed in the neutron beam of the F-1 research reactor [1]. The assembly has 49 channels, arranged with a pitch of 25 cm. The graphite is heated by means of electric heater rods, placed at the periphery of the graphite brickwork. The nominal power of the electric heaters is 300 KW.

As thermocouple measurements demonstrated, the graphite temperature distribution in all of the experiments was uniform over the height of the assembly. In the assembly without water in the channels, the temperature field was also homogeneous in the horizontal plane. In the experiments with water in the channels, the graphite temperature distribution in the horizontal plane is nonuniform, however, there is a region in the middle of the assembly which encompasses the nine central channels, where the gradient of the graphite temperature is insignificant (Figure 3). Such a temperature field is introduced by means of choosing the water rate of flow in the individual channels.

Special steps were taken to obtain higher channel to graphite temperature gradients. In order to reduce the heat transfer from the graphite to the channel to a minimum, air gaps of 1.5 to 2.0 mm were created between the pipes and the graphite, which were hermetically sealed at the channel entrance and exit points from the graphite brickwork; the surface of the pipes was polished. In this case, it proved possible within the limits of a cell to obtain a stepped change in the temperature (Figure 4), in which case, the temperature drop over the graphite did not exceed 7 °C, while the channel temperature (the cassette, water and pipe) was equal to the water temperature. The studied temperature modes are shown in Table 1 as compared to the RBMK reactor. It can be seen from these data that the test stand made it possible to not only model the RBMK temperature gradient, but to perform studies in a wider range.

The dimensions of the assembly, which are more than five neutron migration lengths, were chosen so that within it, there would be a rather large region with an asymptotic neutron spectrum. Measurements of the activity distributions of the neutron detectors for various energy groups, including ^{238}U in cadmium filters and without them, ^{115}In, ^{239}Pu, ^{235}U and ^{55}Mn showed that the dimensions of the region with an asymptotic spectrum amount to no less than 100 x 100 x 100 cm.

By definition, the measured spectral index is the normalized ratio for the known spectrum of the activities of two detectors, one of which has a resonance in the energy range under study; the activation cross-section of the second approximately follows a 1/v law:

$$S_{(1,2)} = \left(\frac{A_1}{A_2}\right)_x \Big/ \left(\frac{A_1}{A_2}\right)_{\text{T. C}}, \quad (1)$$

where x indicates that the activities of detectors A_1 and A_2 are measured in the spectrum being studied; T.C indicates measurement in the known spectrum, usually the thermal spectrum.

The following spectral indices were measured in this paper: $S(^{176}Lu, {}^{55}Mn)$; $S(^{239}Pu, {}^{235}U)$; $S(^{115}In, {}^{55}Mn)$ and $S(^{197}Au, {}^{55}Mn)$. The detectors utilized foil disks made of dispersion alloys with aluminum; and manganese in the form of an alloy with nickel. The detector parameters are given in Table 2 along with the thermal neutron absorption cross-sections σ_a (0.0253 eV) [2] and the cross-sections at the maximum of the resonance peak, σ_{aR}, which were used in calculating the self-shielding coefficients for the thermal neutrons G_T and the resonance neutrons G_R. These coefficients were determined using the formulas of paper [3], which are a good approximation when $\Sigma_a\delta < 0.05$:

$$G_T = \frac{1}{1+2\Sigma_{aT}\delta};\quad G_R = \frac{1}{\sqrt{1+2\Sigma_{aR}\delta}}, \qquad (2)$$

where δ is the thickness of the foil in cm. It can be seen from Table 2 that the detectors which were used proved to be rather thin (the coefficients G_T and G_R are extremely close to unity).

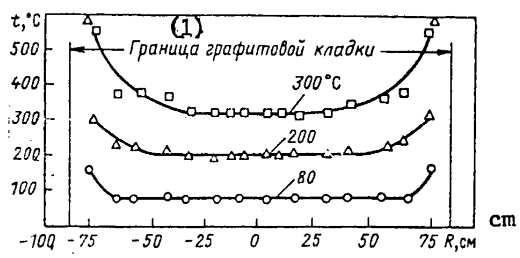

Figure 3. The graphite temperature distribution in the horizontal plane in the assemblies with water in the process channels.

Key: 1. Boundary of the graphite brickwork.

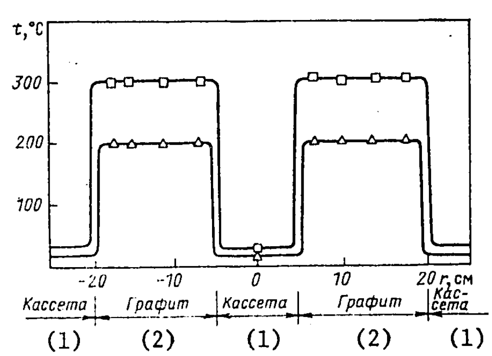

Figure 4. The temperature distribution in the horizontal plane of an elementary cell for an assembly with water in the process channels: the squares and triangles are measured values; the solid line is the thermophysical calculation.

Key: 1. Cassette;
2. Graphite.

The diameter of all of the detectors matched the diameter of the fuel tablet. In the fuel elements, the detectors were insulated from the fuel by aluminum disks 0.05 mm thick; fuel tablets 10 mm thick were placed between the various detectors.

The measurements reduced to the simultaneous irradiation of the set of detectors in the assembly (in the typical fuel elements of cassettes: in the center of the cassette, in the inner and outer fuel element rings and in the graphite) and in the thermal spectrum, for which the spectrum of a graphite thermal column with dimensions of 120 x 120 x 240 cm was used, which was installed in the F-1 reactor [1]. The temperature of the graphite in the thermal column amounted to 21 + 1 °C.

For the fissioning nuclides, following irradiation, the integral gamma activity of the fission products formed in the detectors was recorded. The discrimination threshold was 400 KeV. The gamma activity was measured with scintillation spectrometers and the beta activity (· 4π) was measured in a beta counter. Corrections were made when processing the results for the difference in the nuclide concentration in the detectors (calibration factors), for the self-shielding and perturbation of the flux by the foils as well as corrections due to the neutron flux gradient over the height of the assembly. The corrections for self-shielding and flux perturbation were determined from formulas of (2), which are justified for an isotropic neutron distribution. The corrections are very close to unity and these estimates are sufficiently precise. A comparison with check calculations by the Monte-Carlo technique, as well as multiple group methods showed that the error in these estimates does not exceed ±1 %.

The random errors in the experiment were computed as the mean square errors σ for a series of independent measurements of equal precision. Each series usually consisted of four to six trials (irradiation with subsequent measurement of the activity). The systematic errors were determined in control experiments or were calculated (Tables 3 and 4, Figures 5-7).

It follows from the cited results that:

1. When water is drained from the channels, the slow neutron spectrum becomes markedly harder because of the reduction (by approximately a factor two) in the average moderating power in a cell. Thus, water as a moderator within a channel plays a very significant part in the thermalization of neutrons in the cell as a whole.

2. Changing the fuel enrichment from 12.7 up to 2.0 percent leads to a hardening of the slow neutron spectrum not only in the channel, but also in the graphite at the cell boundary. This is due to the substantial increase (by approximately a factor of 1.5) in the average absorption cross-section through the cell.

3. Heating both the entire assembly and the individual regions of the cell, as was assumed, leads to a neutron temperature rise, and as a consequence, to an increase in the spectral indices which are sensitive to a change in it: S(Lu, Mn) and S(Pu, U). At the same time, the index S(In, Mn) changes extremely little with temperature because of the fact that the indium resonance falls in the epithermal region of the spectrum.

TABLE 2

The Parameters of the Detectors

Параметр Parameter	^{239}Pu	^{235}U*	^{176}Lu	^{55}Mn	^{115}In	^{197}Au
Резонансная энергия, эВ (1)	0,296	~1/v **	0,141	337 **	1,46	4,91
Массовое содержание в сплаве, % (2)	17	17	15	20	1,0	1,0
Толщина фольги, мм (3)	0,07	0.07	0,1	0,15	0,1	0,1
σ_a, б	1011	681	2100	13,3	202	99
σ_{aR}, б	3500	1000	13 000	—	27 000	35 000
Σ_a, см$^{-1}$	1,37	0,76	0,12	0,03	0,032	0,01
Σ_{aR}, см$^{-1}$	4,34	0,65	0,55	—	4,28	2,81
G_T	0,980	0,988	0,997	0,999	0,999	0,999
G_R	0,970	0,994	0,995	—	0,960	0,976
Вид регистрируемой активности Kind of activity registered:	γ	γ	β	γ	γ	β

* Обогащение 90%. 90% enriched.
** Малая резонансная активация. Small resonance activation.

Key: 1. Resonance energy, eV;
2. Mass content in the alloy, percent;
3. Foil thickness, mm.

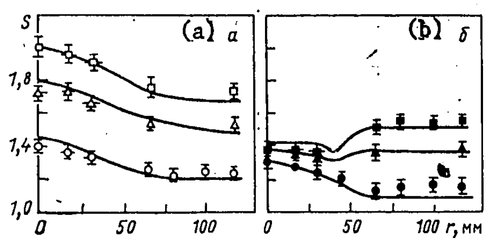

Figure 5. The S(Lu, Mn) spectral index in an elementary cell for a lattice of cassettes with two percent enriched uranium.

Key: a. An assembly without water: the light circles, triangles and squares are for t = 20, 200 and 300 °C respectively;

b. An assembly with water: dark circle = $t_{cass.} = t_{graph.} = 20$ °C; dark triangle = $t_{graph.} = 200$ °C, $t_{cass.} = 30$ °C; dark square = $t_{graph.} = 300$ °C, $t_{cass.} = 40$ °C.

The curves were plotted using the THERMOS program.

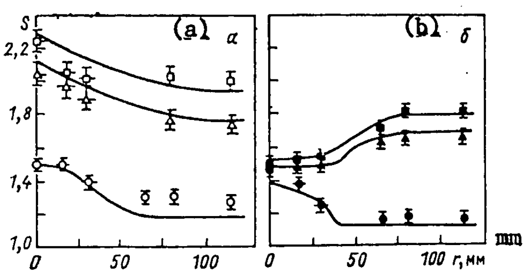

Figure 6. The S(Pu, U) spectral index in an elementary cell for a lattice of cassettes with two percent enriched uranium (see Figure 5 for the explanation of the symbols).

The calculated data cited in Table 3 and 4 were obtained using the VRM [4] and the THERMOS [5] programs. The VRM program is used for engineering calculations of RBMK reactors with fuel assemblies made of rod type fuel elements. The fuel channel constants needed for heterogenous calculations were determined using this program. The uranium burnup and the neutron balance in the fuel overload mode, as well as the isotope composition of the fuel, reactivity effects and the channel power as a function of time for specified geometric dimensions of the channel and cell, the initial fuel enrichment, average channel power and neutron leakage outside the reactor were likewise determined. The major feature of the VRM program is the ultimate simplicity of the algorithms incorporated in it. The spectrum of the thermal and epithermal neutrons is represented in the form of a sum of the Maxwell spectrum with an effective neutron temperature which depends both on the coordinates and the Fermi spectrum. The contribution of epithermal neutrons is determined by the spectral hardness coefficient. A Westkott Δ_r

function was used as the function which relates the thermal and epithermal regions of the spectrum [6]. The effective neutron temperature is determined in a P_1L_1 approximation with a correction for spectral hardness in an individual fuel element. The temperature approximation makes it possible to use the system of Westkott cross-sections [6]. The thermal neutron flux is determined in a diffusion approximation for a cell with an open outer boundary. The program generates the average neutron fluxes with respect to the cell zone and the spectral indices.

A comparison of the results calculated using the VRM program with the experimental data (see Tables 3 and 4) shows that:

1. The VRM program provides a good determination of the most important spectral index S(Pu, U). Practically all of the calculated values do not fall outside the limits of measurement error.

2. The agreement for the S(Lu, Mn) spectral index can be considered satisfactory, with the exception of some data for hot assemblies, for which the divergence reaches 12 percent; this can be explained by the distortion of the Maxwell component of the neutron spectrum.

3. The VRM program overstates the S(In, Mn) and S(Au, Mn) indices in the fuel by an average of 10 percent. At the same time, the agreement with the experimental data is quite satisfactory for graphite. We will note that these divergences with respect to S(In, Mn) are typical of calculations of the index because of its great sensitivity to epithermal neutrons.

Thus, the VRM program on the whole does satisfactory calculations of the spectral indices in RBMK lattices, despite the simplicity of the algorithm incorporated in it.

Detailed calculations of the spectral indices within the bounds of a cell were made using the THERMOS program [5], adapted for uranium-graphite systems by A.A. Ivanov. This is a multibanned multigroup program, which solves the integral transport equation in the thermal energy range for an infinitely long cell of a reactor with cylindrical symmetry. Nelkin's model was used in the calculation of the scattering nucleus for hydrogen and a free gas model was used for graphite and oxygen. The transport nucleus is computed by a first collision probability method. The neutron moderation density in the thermal region was assumed to be spatially homogeneous within the bounds of a cell. The calculations was performed in a 15-group approximation in a neutron energy range of 0 to 0.9 eV; the number of zones over the radius of a cell was 15. A comparison with experimental data (see Figures 5-7) shows that the THERMOS program does good calculations of the S(Lu, Mn) and S(Pu, U) spectral indices, i.e., it can be successfully employed for detailed calculations of thermal neutron spectra in RBMK type lattices.

TABLE 3

Spectral Indices for a Lattice of Two Percent Enriched Cassettes*

Индекс Index	(1) Наличие воды в каналах	(2) Температура зон ячейки, °C: (3) Графит	(2) Температура зон ячейки, °C: (4) Канал	Cassette Кассета: Эксперимент (5)	Cassette Кассета: (6) Расчет ВРМ VRM	Cassette Кассета: (6) Расчет THERMOS	Graphite Графит: Эксперимент (5)	Graphite Графит: (6) Расчет ВРМ VRM	Graphite Графит: (6) Расчет THERMOS
S (Lu, Mn)	Нет No	20	20	1,43±0,03	1,35	1,39	1,28±0,03	1,25	1,20
		200	200	1,92±0,07	1,70	1,97	1,71±0,06	1,72	1,76
		300	300	2,07±0,07	1,87	2,17	2,02±0,07	1,92	2,00
	Есть Yes	20	20	1,29±0,03	1,29	1,26	1,16±0,03	1,18	1,12
		200	30	1,46±0,03	1,44	1,47	1,65±0,64	1,67	1,68
		300	40	1,50±0,03	1,52	1,53	1,78±0,04	1,89	1,78
S (Pu, U)	Нет No	20	20	1,36±0,03	1,41	1,37	1,23±0,03	1,22	1,22
		200	200	1,67±0,03	1,62	1,68	1,50±0,04	1,49	1,54
		300	300	1,92±0,05	1,82	1,92	1,72±0,05	1,70	1,70
	Есть Yes	20	20	1,24±0,02	1,27	1,24	1,15±0,03	1,13	1,10
		200	30	1,33±0,02	1,33	1,34	1,38±0,04	1,36	1,35
		300	40	1,36±0,02	1,37	1,40	1,55±0,04	1,54	1,51
S (In, Mn)	Нет No	20	20	3,27±0,07	3,76	—	2,40±0,04	2,55	—
	Есть Yes	20	20	2,56±0,05	2,80	—	1,91±0,04	1,92	—
		200	30	2,57±0,06	2,81	—	2,05±0,04	2,10	—
		300	40	2,59±0,05	2,80	—	2,12±0,04	2,20	—
S (Au, Mn)	Нет No	20	20	2,91±0,06	3,41	—	2,35±0,05	2,37	—
	Есть Yes	20	20	2,37±0,08	2,57	—	1,78±0,05	1,81	—

* В табл. 3 и 4 приведены средние значения спектральных индексов для топлива и графита.

*The average values of the spectral indices for the fuel and graphite are given in Tables 3 and 4.

Key:
1. Water present in the channels ;
2. The temperature of the zones of a cell, °C;
3. Graphite;
4. Channel;
5. Experiment;
6. Calculated.

TABLE 4

The Spectral Indices in a Lattice of Cassettes with Natural Uranium Oxide

Индекс Index	(1) Наличие воды в каналах	(2) Температура зон ячейки, °C: (3) Графит	(4) Канал	Cassette Кассета: (5) Эксперимент	(6) Расчет: ВРМ VRM	THERMOS	Graphite График: (5) Эксперимент	(6) Расчет: ВРМ VRM	THERMOS
S (Lu, Mn)	Нет No	20	20	1,33±0,03	1,30	1,26	1,20±0,03	1,20	1,14
	Есть Yes	20	20	1,21±0,03	1,19	1,17	1,12±0,03	1,13	1,08
		80	20	1,25±0,03	1,23	1,21	1,29±0,04	1,31	1,24
		80	70	1,38±0,04	1,38	1,36	1,31±0,04	1,34	1,30
		200	30	1,36±0,04	1,36	1,34	1,49±0,04	1,66	1,47
		300	40	1,45±0,03	1,46	1,44	1,70±0,05	1,90	1,64
S (Pu, U)	Нет No	20	20	1,23±0,02	1,22	1,22	1,17±0,03	1,14	1,14
	Есть Yes	20	20	1,12±0,02	1,13	1,10	1,11±0,03	1,08	1,07
		80	20	1,17±0,03	1,14	1,16	1,13±0,03	1,14	1,10
		80	70	1,21±0,03	1,19	1,2	1,15±0,02	1,15	1,13
		200	30	1,18±0,03	1,18	1,19	1,28±0,02	1,30	1,24
		300	40	1,23±0,03	1,22	1,28	1,42±0,04	1,48	1,42
S (In, Mn)	Нет No	20	20	2,16±0,05	2,35	—	1,88±0,04	1,95	—
	Есть Yes	20	20	1,76±0,05	1,87	—	1,53±0,05	1,55	—
		80	20	1,74±0,05	1,87	—	1,54±0,04	1,58	—
		80	70	1,74±0,06	1,87	—	1,54±0,06	1,58	—
		200	30	1,75±0,07	1,86	—	1,59±0,06	1,66	—
		300	40	1,76±0,06	1,86	—	1,68±0,05	1,71	—

Key: 1. Water present in the channel?;
2. The temperature of the cell zones, °C;
3. Graphite;
4. Channel;
5. Experiment;
6. Calculated.

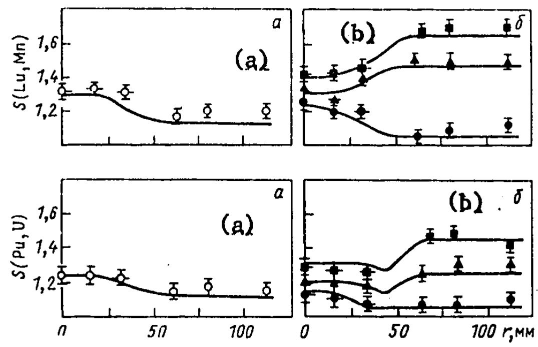

Figure 7. The S(Lu, Mn) and S(Pu, U) spectral indices in an elementary cell for a lattice of cassettes with natural uranium dioxide (see Figure 5 for an explanation of the symbols).

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8225
CSO: 8144/1065-A

NUCLEAR ENERGY

UDC 621.317:621.039

TECHNIQUES FOR MEASURING DISTORTIONS IN THE TECHNOLOGICAL CHANNELS OF NUCLEAR REACTORS

Moscow TEKHNIKA YADERNYKH REAKTOROV: TEKHNIKA IZMERENIYA ISKRIVLENIY TEKHNOLOGICHESKIKH KANALOV YADERNYKH REAKTOROV in Russian No 12, 1981 (signed to press 1 Aug 80) pp 2, 80

/Annotation and table of contents from booklet "Nuclear Reactor Technology: Techniques for Measuring Distortions in the Technological Channels of Nuclear Reactors", by Adol'f Ivanovich Trofimov, Boris Moiseyevich Kerbel', Mikhail Yur'yevich Korobeynikov and Svetlana Denisovna Stepanichenko, Energoizdat, 1,100 copies, 80 pages/

/Text/ ANNOTATION

This booklet examines, for the first time, questions concerning the measurement of distortions in the technological channels of nuclear reactors and gives descriptions of the instruments used for this purpose. The authors analyze the techniques used to calculate the shapes of the distortion of the axes of technological channels and propose an optimum technique that allows for the structural features of the channels as well as the metrological characteristics of the instruments.

Although it is intended for engineers and scientific workers who are concerned with the problems of monitoring the parameters of nuclear power reactors, this booklet can also be useful for teachers and students in corresponding specialties. Figures 45; references 43.

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11746
CSO: 1861/170

UDC 621.039.5

CHARACTERISTICS OF THE PLANNING AND CONSTRUCTION OF NUCLEAR ELECTRIC FACILITIES

Moscow OSOBENNOSTI PROYEKTIROVANIYA I SOORUZHENIYA AES in Russian 1980 (signed to press 4 Dec 80) pp 2, 289

[Annotation and table of contents from book "Characteristics of the Planning and Construction of Nuclear Electric Facilities", by Leonid Mikhaylovich Voronin, Atomizdat, 4000 copies, 190 pages]

[Text] The book outlines the major questions that arise in development of designs of nuclear electric facilities with various types of reactors. An examination is made of methods and stages of construction and installation on nuclear power stations. Principal attention is given to the features specific to nuclear electric facilities. Considerable space is given to topics of ensuring high quality of construction, erection and millwright work, which is especially important for reliable operation of the nuclear electric plant. The materials are based on experience in planning, building and operating Soviet nuclear electric plants with water-cooled water-moderated and channel reactors.

For specialists in the area of planning, building and operating nuclear electric plants. May be used by students in engineering colleges majoring in the corresponding subjects.

Tables 15, figures 73, references 53.

Contents

6610
CSO: 1861/161

NON-NUCLEAR ENERGY

UDC 62.-83:537.84

AUTOMATED MAGNETOHYDRODYNAMIC DRIVE

Moscow AVTOMATIZIROVANNYY MGD-PRIVOD in Russian 1980 (signed to press 15 Oct 80) pp 2, 159-160

/Annotation and table of contents from book "Automated Magnetohydrodynamic Drive", by Khugo Aleksandrovich Tiysmus and Yukhan Yaanovich Laugis, Izdatel'stvo "Energiya", 2,300 copies, 160 pages/

/Text/ ANNOTATION

The authors discuss questions related to the investigation and designing of a magnetohydrodynamic electric drive with a liquid metal secondary system based on plane linear and cylindrical induction motors. They present a classification of MHD drives, methods for calculating their hydromechanical characteristics, and the most convenient methods and equipment for controlling the feed and pressure in an MHD drive.

This book is intended for engineers working in the field of automated electric drives, as well as scientific workers, graduate students and senior students specializing in the field of electromechanics.

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CSO: 1861/166

UDC (622.24.05+622.242)(071.2)

DRILLING MACHINES AND MACHINERY

Moscow BUROVYYE MASHINY I MEKHANIZMY in Russian 1980 (signed to press 10 Nov 80) pp 2, 389-391

[Annotation and table of contents from book "Drilling Machines and Machinery", by Valeriy Aleksandrovich Lesetskiy and Aleksandr Longinovich Il'skiy, Izdatel'stvo "Nedra", 15,500 copies, 392 pages]

[Text] In the second edition of the textbook (first edition -- 1968), new contemporary drilling equipment and machinery are described: drilling rigs, derricks, block and tackle systems, hoists, swivels, rotors, pumps, actuators, a blow-out preventer, turbodrills, electric drills and equipment for preparing and purifying muds and for cementing boreholes. Their schematics, layouts, operating principles, installation and operation are examined. The necessary calculations are presented.

The textbook is intended for students in petroleum technical schools, and it may also be useful for mechanics and technicians at drilling enterprises.

Tables -- 41, illus. -- 189.

CONTENTS

9194
CSO: 1861/172

UDC 62-83:621.313-12

CALCULATION OF ELECTROMAGNETIC AND HEAT CONDITIONS OF MHD AND LINEAR ELECTRIC MOTORS

Tallinn TRUDY TALLINSKOGO POLITEKHNICHESKOGO INSTITUTA: RASCHET ELECTROMAGNITNYKH I TEPLOVYKH REZHIMOV MAGNITOGIDRODINAMICHESKIKH I LINEYNYKH ELEKTRODVIGATELY in Russian 1980 (signed to press 18 Dec 80) p 93

[Table of contents from book "Proceedings of Tallinn Polytechnical Institute: Calculation of Electromagnetic and Heat Conditions of MHD and Linear Electric Motors. Automated MHD and Linear Electric Drives I", edited by T. Veske, Tallinn Polytechnical Institute, 300 copies, 94 pages]

[Text] Contents

6610
CSO: 1861/158

INDUSTRIAL TECHNOLOGY

UDC 658.5:621.003.13

PLANNING IN SCIENTIFIC AND TECHNICAL ORGANIZATIONS IN THE MACHINE-BUILDING INDUSTRY

Leningrad PLANIROVANIYE V NAUCHNO-TEKHNICHESKIKH ORGANIZATSIYAKH MASHINOSTROYENIYA in Russian 1980 (signed to press 28 Oct 80) pp 2, 311-312

/Annotation and table of contents from book "Planning in Scientific and Technical Organizations in the Machine-Building Industry", by Konstantin Fedorovich Puzynya, Leningrad Branch, Izdatel'stvo "Mashinostroyeniye", 4,000 copies, 312 pages/

/Text/ ANNOTATION

The author explains the essence of intrastructural planning in the machine-building industry's NII's /scientific research institute/ and KB's /design office/. He discusses methods for selecting project topics and calculating the planned technical, economic and social indicators of NII and KB development. There is a description of progressive systems for developing volume-calendar plans and the operational planning of the work of NIOKR /scientific research and experimental design work/ leaders and performers. The author also proposes a system of planned norms and methods for calculating the most important of them.

This book is intended for leaders and engineering and technical personnel, as well as specialists in the planning services of scientific research organizations. It can also be useful to students and graduate students in technical and economic VUZ's.

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CSO: 1861/167

UDC 621.311.016.35-52
621.224.5
621.311.21.0025:532.5

MEASURES FOR INCREASING THE MOBILITY OF GES EQUIPMENT: POWER ASSOCIATION STABILITY

Alma-Ata MERY POVYSHENIYA MOBIL'NOSTI AGREGATOV GES: USTOYCHIVOST' ENERGO-OB"YEDINENIY in Russian 1979 (signed to press 26 Sep 79) pp 2, 213-215

/Annotation and table of contents from book "Measures for Improving the Mobility of GES Equipment: Power Association Stability", by Abdu-Khalik Magomedovich Tamadayev, Izdatel'stvo "Nauka", Kazakh SSR, 700 copies, 216 pages/

/Text/ ANNOTATION

In this monograph, the author describes methods for emergency power control (EPC) of GES turbines in order to improve the dynamic stability of parallel operating modes. He explains their theoretical principles and the results of computer calculations and experimental testing on physical models and under full-scale conditions. He also lists the most effective areas for utilization of the methods and describes the power change laws, advantages, disadvantages and other characteristics. The author points out the areas in power engineering in which these developments can be used. He discusses the principles of the combined use of known electrical measures for increasing stability with these emergency turbine power control methods, analyzes the technical and national economic limitations on the mobility of GES equipment, and indicates some measures for combatting these limitations and paths for the further development of the basic equipment.

This book is intended for specialists concerned with automatic emergency equipment in power systems and improving the degree of economy and reliability in their operation. It will also be useful for engineers and hydromechanics specialists, as well as scientific workers and VUZ students in the appropriate specialties.

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UDC 621.833.389:531.2

STATICS OF GLOBOID GEARING

Moscow STATIKA GLOBOIDNYKH PEREDACH in Russian 1981 (signed to press 27 Jan 81) pp 2, 197-198

[Annotation and table of contents from book "Statics of Globoid Gearing", by Eduard Leonovich Ayrapetov, Mikhail Dmitriyevich Genkin and Tat'yana Nikiforovna Mel'nikova, Institute of Machine Science imeni A. A. Blagonravov, Izdatel'stvo "Nauka", 1000 copies, 199 pages]

[Text] The book gives the results of theoretical and experimental studies of static loading of globoid gearing. To disclose the static indeterminacy of globoid gearing, methods are outlined for calculating the strain of the major gearing components: the worm thread and gear teeth, the worm shaft and gear rim, the bearings and casing of transmissions; an investigation is made of the patterns of errors in installation with regard to play in engagement; methods are proposed for mutual compensation of errors and elastic deformations of gearing components; A study is made of the load distribution along contact lines and between the teeth of a worm wheel with consideration of the wear-in properties of contacting surfaces, errors and elastic deformations of gearing components.

The book is intended for scientific workers, design engineers, instructors and students in institutions of higher education.

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CSO: 1861/155

NAVIGATION AND GUIDANCE SYSTEMS

UDC 629.78.077.001.24

DESIGNING MANUAL CONTROL SYSTEMS FOR SPACECRAFT

Moscow PROYEKTIROVANIYE SISTEM RUCHNOGO UPRAVLENIYA KOSMICHESKIKH KORABLEY in Russian 1978 (signed to press 19 Apr 78) pp 2, 143

/Annotation and table of contents from book "Designing Manual Control Systems for Spacecraft", by Viktor Aleksandrovich Klimov, Boris Vasil'yevich Bludov, Valeriy Mikhaylovich Vasilets, Vladimir Aleksandrovich Leonidov, Valentin Valentinovich Nikol'skiy, Anatoliy Vasil'yevich Tumanov and Andrey Ivanovich Yakovlev, Izdatel'stvo "Mashinostroyeniye", 1,700 copies, 144 pages/

/Text/ ANNOTATION

In this book the authors discuss various problems involved in designing systems for the manual control of the movement of spacecraft. They formulate the basic common stages in designing the systems and explain the special features of the physical and mathematical modeling. They also present a mathematical description of the operator's activities.

There is an explanation of the new algorithms for the mathematical modeling of manual control systems for spacecraft that are notable for their advantages in providing calculative stability and computation accuracy and also require a relatively small amount of time to model both linear and nonlinear systems.

This book is intended for engineering and technical workers specializing in the field of design spacecraft control systems. It can also be useful to scientific workers, graduate students and VUZ students in the appropriate specialties.

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CSO: 1861/164

UDC 629.7.05.011.2(082)

ADAPTIVE COORDINATE-PARAMETRIC CONTROL OF NONSTATIONARY OBJECTS

Moscow ADAPTIVNOYE KOORDINATNO-PARAMETRICHESKOYE UPRAVLENIYE NESTATSIONARNYMI OB"YEKTAMI in Russian 1980 (signed to press 2 Oct 80) pp 2, 240-243

/Annotation and table of contents from book "Adaptive Coordinate-Parametric Control of Nonstationary Objects", by Boris Nikolayevich Petrov, Vladislav Yul'yevich Rutkovskiy and Stanislav Danilovich Zemlyakov, Institute of Control Problems, USSR Academy of Sciences, Izdatel'stvo "Nauka", 1,300 copies, 244 pages/

/Text/ ANNOTATION

The authors discuss questions concerning the control of objects, the dynamic characteristics of which change with time, within broad limits, during the operating process. They introduce a class of coordinate-parametric control systems that is capable of providing a considerable expansion of the possibilities for adaptive control of nonstationary objects. The basic results were obtained with respect to the class of adaptive systems for coordinate-parametric control that is based on nonsearch adaptive control systems with a standard model.

This book is intended for specialists engaged in designing and introducing control systems and scientific workers in the field of control theory. It can also be useful for senior students and graduate students specializing in the field of control of nonstationary objects.

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CSO: 1861/162

FLUID MECHANICS

UDC 532

PLANE PROBLEMS IN HYDRODYNAMICS AND AERODYNAMICS

Moscow PLOSKIYE ZADACHI GIDRODINAMIKI I AERODINAMIKI in Russian 1980 (signed to press 1 Sep 80) pp 2-5

/Annotation and table of contents from book "Plane Problems in Hydrodynamics and Aerodynamics", by Leonid Ivanovich Sedov, Main Editorial Office of Physics and Mathematics Literature, Izdatel'stvo "Nauka", third edition, 1,900 copies, 448 pages/

/Text/ ANNOTATION

Achievements in modern hydromechanics and aerodynamics are closely related to the theory of plane-parallel movements of an incompressible liquid and gas. The results of this theory are widely used to explain experimental observations and to model natural phenomena, as well as in engineering calculations of the flight of various aircraft, the operating modes of hydraulic and gas machines and the hydrodynamics of ships and screw propellers. They are also used to study the high-speed movement of bodies in water, the rapid submergence of bodies in water and other questions.

In this book, the author discusses a large number of problems in the areas mentioned above.

This monograph is intended for scientific workers and engineers concerned with aircraft research and design, hydraulic and gas machines, ships and screw propellers and so on, and for students taking higher courses in universities and aviation, shipbuilding and other higher technical education institutions. Figures 151; references 275.

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CSO: 1861/165

TESTING AND MATERIALS

UDC 621.3

SPECIAL-PURPOSE ELECTROMAGNETIC AND ELECTROMECHANICAL CONTROL AND MONITORING DEVICES

Tallinn TRUDY TALLINSKOGO POLITEKHNICHESKOGO INSTITUTA: ISSLEDOVANIYE ELEKTROMAGNITNYKH I ELEKTROMASHINNYKH USTROYSTV UPRAVLENIYA I KONTROLYA SPETSIAL'NOGO NAZNACHENIYA in Russian 1980 (signed to press 12 Dec 80) p 47

[Table of contents from book "Proceedings of Tallinn Polytechnical Institute: Special-Purpose Electromagnetic and Electromechanical Control and Monitoring Devices. Electromechanics X", edited by R. Vyrk, Tallinn Polytechnical Institute, 300 copies, 47 pages]

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